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Survival and Functional Outcome After Prolonged Intensive Care Unit Stay

Pamela A. Lipsett, MD,*† Sandra M. Swoboda, RN, MS,† Jennifer Dickerson, BSN,§ Michelle Ylitalo, RN, MS,†
Toby Gordon, SCD,‡ Michael Breslow, MD,* Kurtis Campbell, MD,* Todd Dorman, MD,*
Peter Pronovost, MD,* and Brian Rosenfeld, MD*

*From the Johns Hopkins University Schools of *Medicine, †Nursing, and ‡Hygiene and Public Health, Health Policy and Management, and the §Johns Hopkins Hospital, Baltimore, Maryland*

Objective
To examine the functional outcome and costs of a prolonged illness requiring a stay in the surgical intensive care unit (SICU) of 7 of more days.

Summary Background Data
The long-term benefits and costs after a prolonged SICU stay have not been well studied.

Methods
All patients with an SICU length of stay of 7 or more days from July 1, 1996, to June 30, 1997, were enrolled. One hundred twenty-eight patients met the entry criteria, and mortality status was known in 127. Functional outcome was determined at baseline and at 1, 3, 6, and 12 months using the Sickness Impact Profile score, which ranges from 0 to 100, with a score of 30 being severely disabled. Hospital costs for the index admission and for all readmissions to Johns Hopkins Hospital were obtained. All data are reported as median values.

Results
For the index admission, age was 57 and APACHE II score was 23. The initial length of stay in the ICU was 11 days; the hospital length of stay was 31 days. The Sickness Impact Profile score was 20.2 at baseline, 42.9 at 1 month, 36.2 at 3 months, and 20.3 at 6 months, and was lower than baseline at 1 year. The actual 1-year survival rate was 45.3%. The index admission median cost was $85,806, with 65 total subsequent admissions to this facility. The cost for a single 1-year survivor was $282,618 (1996).

Conclusions
An acute surgical illness that results in a prolonged SICU stay has a substantial in-hospital death rate and is costly, but the functional outcome from both a physical and physiologic standpoint is compatible with a good quality of life.

The practice of critical care medicine involves sustaining and prolonging the life of critically ill patients who in prior years would otherwise have died. The development of new technologies has allowed this practice to extend to all ages of life and disease processes. In the past, the outcomes of these medical interventions have been assessed only on the ability (or lack thereof) to sustain lives. Quality of life is widely accepted as an important outcome of care after medical interventions. In critically ill patients, establishing a good quality of life outcome is important because prolongation of life may result in a health outcome that is considered worse than death.[1] This assessment of quality of life should reflect the patient's general physiologic and psychological status. The Sickness Impact Profile is a generic health care evaluation tool that has been validated in a wide variety of patients, including critically ill patients.[2–4]

The costs of intensive care consume a large fraction of the available funds and can account for a disproportionate amount of resources dedicated to patients with a poor prognosis.[5–8] A recent consensus conference concluded that "future outcome evaluation of intensive care should incorporate quality of life [measures]" and that "further research into patient preferences as well as cost-effectiveness and cost utility studies are necessary to develop guidelines for use of scarce ICU resources which reflect the values of both society and individual patients."[9] The SUPPORT study

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Correspondence: Pamela A. Lipsett, MD, 600 N. Wolfe St., Blalock 605, Baltimore, MD 21287-4605.
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examined patient preferences but did not specifically include surgical patients; rather, it focused on patients with a limited prognosis, with an expected 50% death rate.[10]

The prognosis of surgical patients with a prolonged surgical critical illness has undergone little study.[4,11–16] Fewer numbers of publications examine quality of life or functional outcome in this patient population.[11,14–16] In this study we sought to examine the outcome of patients with a prolonged surgical intensive care unit (SICU) stay, measuring the death rate and functional outcome at serial interviews over a 1-year period. Hospital costs for patient care attributed to this admission and any readmission to the index hospital were obtained.

METHODS

From July 1, 1996, to June 30, 1997, all patients in the SICU at Johns Hopkins Hospital with a continuous length of stay greater than 6 days were enrolled into a prospective evaluation of outcome. A period of more than 6 days of continuous SICU stay was selected because it represented the top 5% length of stay (LOS) of SICU patients and 90% variance in costs from the three previous years. Johns Hopkins Hospital is a 1027-bed tertiary and quaternary referral center that also provides primary care to the local Baltimore region. The SICU is a 16-bed unit with dedicated intensive care attendings, fellows, and house staff. The SICU primarily cares for all adult general surgical and surgical subspecialty patients, excluding cardiac and neurosurgery specialties. However, traumatic injuries involving these specialties are treated in the SICU. This study was approved by the Institutional Review Board, and all patients or their families provided written informed consent for inclusion into this study.

Demographics, diagnosis, APACHE II score on SICU admission, and charge data were collected on each patient's index admission and for any Johns Hopkins readmission during the study period. Under Maryland's rate-regulated health care system, administered by the Health Services Cost Review Commission, patient charges are controlled and reported to a central database. These patient charges are adjusted for cost centers and serve as the standard for patient costs across the state. Patients (or surrogates) were interviewed at admission for baseline functional status and serially at 1, 3, 6, and 12 months. Baseline status was considered to be the functional status within the 2 weeks before hospital admission, and thus may have included some dysfunction related to acute illness.

Quality of life was measured using the Sickness Impact Profile (SIP).[2,3] The SIP is a multidimensional and cumulative health index consisting of 136 questions divided into 12 categories. Three of these categories are aggregated into the Physical Dimension Score (ambulation, mobility, and body care). The categories "social interactions," "alertness behavior," "emotional behavior," and "communication" are aggregated into the psychosocial dimension. The other five are independent categories. The questionnaire explores specific areas of daily activity and can be self-administered or completed by a trained interviewer. Because the reliability of the SIP is enhanced by a trained interviewer, in this study every effort was made to have the patient interviewed in person or on the telephone by the same trained interviewer at each specific time point. In five cases the forms were self-administered after the initial personal interview confirmed reliability. Each interviewer was specifically trained and tested for test–retest reliability on five test patients.

A SIP score is calculated from the dysfunction score attributed to each question. Total SIP and individual category dysfunction scores are expressed as a percentage of the sum of the weights of the affirmatively checked statements, divided by the sum of all factor weights under analysis. The general adult population has a SIP score of approximately 5; a SIP score of 20 indicates the need for substantial daily care and a score of more than 30 the need for almost complete care.

Data were analyzed using the SPSS for Windows statistical software package (Release 7.5; SPSS Inc., Chicago, IL). SICU LOS, hospital LOS, SIPS score, and age were not normally distributed; therefore, data are presented as median and 25th and 75th percentiles. The Mann-Whitney test, chi-square, or chi square exact were used as appropriate to compare demographics of respondents and nonrespondents. Comparisons of survivors and nonsurvivors and functional health status of survivors were made using Mann-Whitney, chi square, chi-square exact, or Kruskal-Wallis (Dunn) test as appropriate. Stepwise logistic regression was used to identify significant factors for predicting 1-year survivors and factors significant for SIP score at 1 year.

RESULTS

During the study period, there were 859 admission into the SICU, with a total of 4,581 SICU patient-days. The study population included 128 patients, with 1-year vital statistics available on 127 patients. Thus, the study population originally selected from historical LOS information as the top 5% LOS patients actually accounted for 14.8% of all SICU admissions and 43.8% of all SICU days. Indications for SICU admission included the need for mechanical ventilation, intensive hemodynamic monitoring and management, or aggressive fluid resuscitation.

Patient demographics are shown in Table 1. The study population did not differ in age, sex, or race from the SICU population at large. APACHE II scores were not obtained on all admissions during the study period. For the group overall, the median SICU LOS was 11 days (range 7–77), with a total hospital median LOS of 30 days (range 7–161).

Diagnosis groups were determined prospectively by historical information. Gastrointestinal surgery (complications of gastrointestinal surgery, 10%; emergency gastrointestinal surgery, 16%; pancreatitis, 17%) accounted for 43% of all patients. Vascular surgery accounted for 22% (elective, 8%;

Table 1. COMPARISON OF RESPONDERS VERSUS NONRESPONDERS

	Responders at 1 year (n = 47)	Nonresponders at 1 year (n = 12)
Age	56 (44–68)	64 (35–74)
Gender (male:female)	32:12	7:5
APACHE II score	21.0 ± 6.5	20.5 ± 6.1
SICU LOS	10 (8,16)	10 (8,13)
Hospital LOS	34 (20,61)	19 (12,36)*
		% of
Diagnosis group	% of Responders	Nonresponders*
GI elective	6	0
GI emergency	19	0
Pancreatitis	17	8
Vascular elective	6	17
Vascular emergency	0	8
Thoracoabdominal aneurysms	11	17
Transplantation	19	0
Trauma	11	33
Other	11	17
Baseline SIP score	16.8 (4.9,32.6)	16.7 (6.9,31.8)

* $P < 0.05$ vs. responders
SICU, surgical intensive care unit; LOS, length of stay; GI, gastrointestinal; SIP, Sickness Impact Profile.

emergency, 3%; thoracoabdominal aneurysm repair, 11%), solid organ transplantation for 17%, trauma for 7%, and other surgical subspecialties for 11% (obstetrics/gynecology, orthopedic spine, and otolaryngology). Within the diagnosis groups, age was significantly different ($P = .001$), with transplant and trauma patients the youngest (40 and 48 years, respectively) and vascular surgery (emergent and elective, 74 and 70 years) the oldest. Diagnosis group also significantly influenced SICU LOS ($P = .02$): patients with pancreatitis had the longest SICU LOS (23 days) and subspecialty patients the shortest (11 days). Hospital LOS was also significantly and more strongly influenced ($P = .004$) by diagnosis group: transplant patients had the longest LOS (66 days) versus a 21-day LOS for trauma patients. The overall APACHE II score at the time of SICU admission was a mean of 23.4 ± 6.6, and this was not influenced by the diagnosis group.

Patients with a complete set of information at 1 year were compared with patients who were alive at 1 year but did not complete the entire questionnaire at that time (Table 1). Hospital LOS shorter in the nonrespondents, and the nonrespondents had a slightly different diagnosis group distribution, with more trauma and vascular patients ($P = .05$).

Survival Data

Vital statistics were known for 127 of the original 128 patients at 1 year (Table 2). Fifty-three (41.4%) of the 128 patients did not survive until hospital discharge. The vast majority of these patients died in the SICU. For the 75 (58.6%) patients who survived until discharge, 58 (45.3%) of the original 128 patients were still alive at 1 year (Fig. 1). Thus, during the year after discharge from a prolonged SICU illness, an additional 17 (13.3%) patients died. Patients who were discharged (58.6%) were most often discharged to a rehabilitation center (28%), to home with home heath care assistance (21%), to a nursing home (7%), to another acute care hospital closer to home (1%), or to other health care facility (1%).

Table 2. SURVIVAL AFTER PROLONGED SICU STAY*

Outcome	Number	%	Cumulative %
Died in SICU	51	39.8	39.8
Died in hospital	2	1.6	41.4
Died within 1 year of discharge	16	12.5	53.9
Alive, SIP assessed at 1 year	47	36.7	90.6
Alive, SIP not assessed at 1 year	11	8.6	99.2
Unknown	1	0.8	100

SICU, surgical intensive care unit; SIP, sickness impact profile.
* n = 128.

Survival as a function of age (Fig. 2), APACHE II score (Fig. 3), or diagnosis group (Fig. 4) is shown. As might be expected, patients who did not survive had a significantly higher APACHE II score (25.8 ± 5.9) than survivors (20.8 ± 6.3, $P = .001$). Patients with an APACHE II score more than 30 had a dismal 1-year survival rate (10%). The overall study mean APACHE II score was 24, and therefore patients in the APACHE II range 20 to 29 and more than 30 explained the overall death rate seen in this study. Median age ($P = .14$), median SICU LOS ($P = .06$), and median hospital LOS ($P = .07$) were not different between survi-

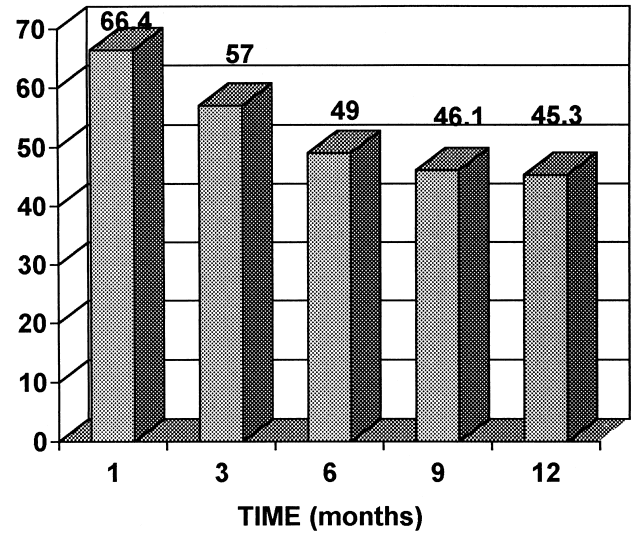

Figure 1. Survival (bars) after a prolonged stay in the surgical intensive care unit.

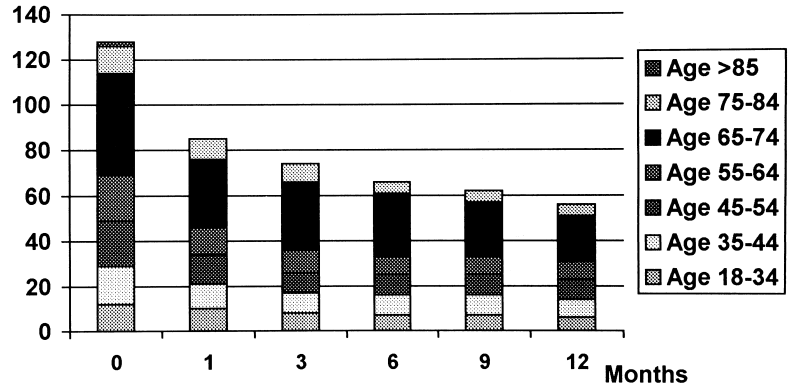

Figure 2. Age group as a function of survival over time.

vors and nonsurvivors. Survival as determined by diagnosis group stratified into the nine categories above was statistically different ($P = .05$). No injured patients died, whereas patients with complications of gastrointestinal surgery (77%) and emergency vascular surgery (75%) had the greatest 1-year death rate. In a multiple regression analysis with age, sex, SICU LOS, hospital LOS, APACHE II score, and diagnosis group as predictors of survival, only an elevated APACHE II score remained a significantly negative predictor of survival.

Functional Status

The overall response rate of the study was excellent at all time points, with patients or family answering the survey in 341 of 391 (87%) possible interviews. In every case the patient was interviewed individually if possible. When the patient's condition did not permit unassisted answering of the questions, family or an appointed surrogate answered the questions with the patient. Any representative of the patient was asked about his or her relationship with the patient and familiarity with the patient's day-to-day activities. At the first examination, there was a substitute for the patient 75% of the time, but that individual had a firm relationship with the patient and was familiar with the patient's day-to-day activities and status. At the 1-year interview, 78% of patients were able to answer for themselves; a surrogate living with the patient answered the remaining questions.

Complete data sets were available for each interview time point for 47 (81%) of the 58 surviving patients; the remaining patients missed an interview point at 1, 3, 6, or 12 months. There were no differences in the median score at baseline between the patients who missed an interview and those who did not. The baseline and serial SIP scores are shown in Figure 5.

Thirty-eight of the 128 patients were transferred to this hospital from another hospital. For the 74 patients with "elective SICU admission," the SIP score obtained at admission to the study probably reflected their true baseline function. Of the patients who were transferred from another hospital, usually with complex gastrointestinal illness, the baseline SIP score may have been related to complications of their condition. Nonetheless, the baseline SIP score was not different between the diagnosis groups overall ($P = .10$). The high baseline median SIP score suggests that patients had substantial underlying dysfunction in combination with either an elective or emergent surgical problem.

At no time point during the serial surveys did the total SIP scores achieve statistical significance between the diagnosis groups. At 3 and 12 months, the physical component of the SIP score trended ($P = .07$ and $P = .08$, respectively) toward a difference, with patients having thoracoabdominal aneurysm repair and solid organ transplan-

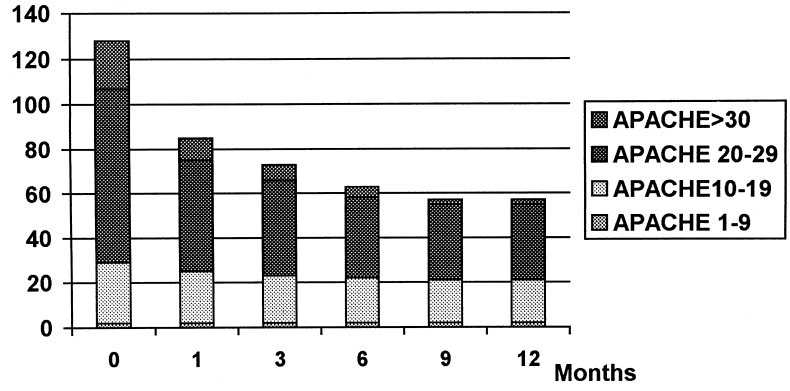

Figure 3. Influence of APACHE II score on long-term survival.

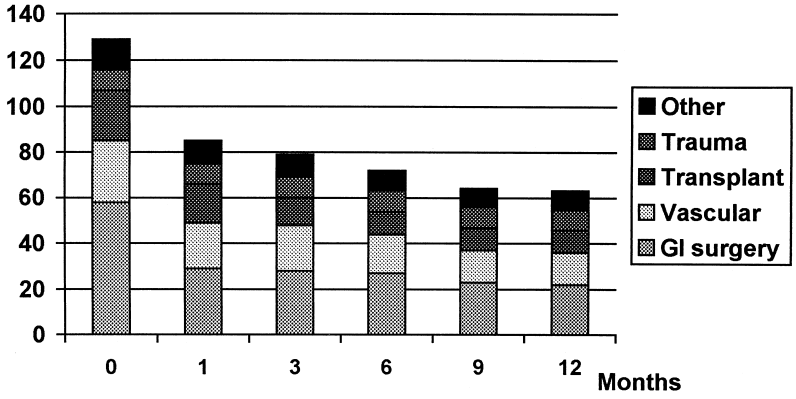

Figure 4. Effect of diagnosis group on long-term survival.

tation having higher scores than trauma and subspecialty patients. The total SIP score peaked at 1 month into the illness, and by 6 months the median level returned to baseline. At 1 year, the overall SIP score and both physical and psychosocial scores were significantly less than at baseline (95% confidence interval, −0.79–11.3, $P = .03$). Not surprisingly, early into the illness, the physical component of the SIP dominated, whereas the psychosocial aspects of the illness were more long-lasting.

Costs

Data for Maryland Health Services Cost Review Commission costs of the index hospital and all admissions to this hospital for the study period were obtained for all patients. The total hospital costs for the index admission for the 128-patient cohort were $15,017,474 (1996). The median cost for surviving patients for the index admission was $84,833 ($23,888, $324,409); for nonsurvivors, it was $86,322 ($23,169, $481,190) ($P = .47$). The total costs associated with nonsurvivors were $8,269,708.

A total of 33 of the 75 discharged patients were readmitted to the hospital during the study period. Of the 33 patients, 29 were readmitted to our hospital for a total of 774 days and a total cost of $1,374,392. The cost of the other four patients readmitted to another hospital could not be obtained.

Thus, the combined hospital costs for this cohort of 128 patients, with 58 1-year survivors, was $16,391,866. This gives a cost of $282,618 (1996) for the first year of survival after a prolonged SICU illness. Costs could not be obtained for care in rehabilitation facilities, home health care, and outside acute care facilities.

DISCUSSION

This study examined the long-term outcome of critically ill surgical patients managed at a large university tertiary-care center who were discharged from the hospital after a prolonged (7 days or more) SICU stay. Seventy-five (59%) of the patients who met this criteria survived until hospital discharge, and 58 (45.3%) of these patients survived a full year after SICU admission. These results were accomplished at a cost of $16,391,866 for the index and subsequent hospital admissions. The cost for a single 1-year survivor was therefore $282,618. Functional outcome as measured by the SIP score serially over the course of 12 months showed improvement at 3, 6, and 12 months; at 12 months, the SIP score was significantly better than baseline and was consistent with a good functional outcome.

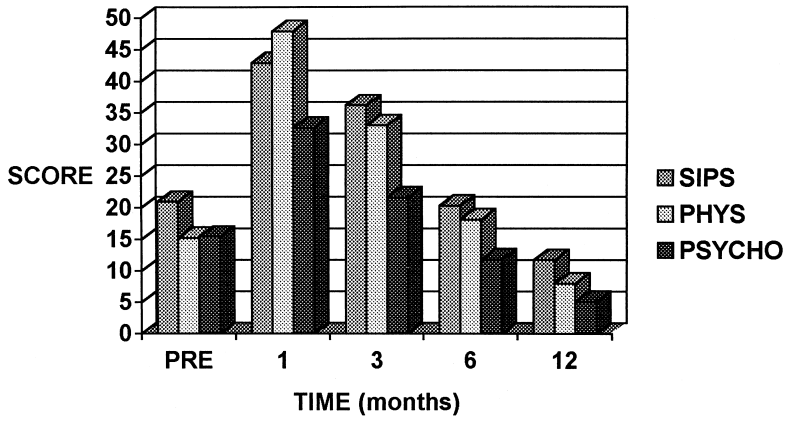

Figure 5. Sickness Impact Profile score (SIPS) over time. PHYS, physical; PSYCHO, psychosocial.

Patient survival at 1 year was correlated only with APACHE II score at patient admission; it was not associated independently with age, sex, or diagnosis. Patients who survived had a trend toward a shorter SICU LOS and a longer hospital LOS than nonsurvivors. This finding is at odds with that in other studies, which demonstrated that nonsurvivors had a shorter SICU stay and lower costs. However, previous authors have concluded that LOS cannot be used as a predictor of long-term outcome.[11,12] Our study results support the findings that survival does not correlate with LOS and that this information "does not support withdrawal of therapy" or provide support for "triage decisions made solely or predominately on the basis of length of stay."[11]

In our cohort, there was no difference in median costs of the index admission between survivors and nonsurvivors. The cost of a 1-year survivor ($282,618, 1996 dollars) was similar to that found in an article by Fakhry et al ($247,812, 1993 dollars).[11] Given inflation and the difference between costs and charges, our study suggests that critically ill patients at our institution surviving a prolonged surgical illness did not incur additional costs, even though technology and the cost of medical care have increased over time. Moreover, the baseline index cost information for a 1-year survivor established in this study can be used to examine and compare cost-effective management strategies and cost for a quality-adjusted life year.

Cullen et al[16] reported on 1-year survival of 226 critically ill surgical patients and demonstrated that 42% of the patients were as productive as they had been at admission; only 18% stated they needed assistance at home. That study involved patients with an average ICU LOS of less than 3 days and is now almost 20 years old. Sage et al[17] reported an 18-month survival rate of 62.9% for emergency surgical patients and an SIP score of 7.4 to 16.1 for patients in the APACHE II range seen in our study. The study by Fakhry et al[11] is similar to ours in that SICU stay was prolonged (26 days) and most patients were discharged from the hospital to a rehabilitation center. However, at 18 months, 72% of patients in that study were functioning independently at home. Similarly, our study demonstrated that survival is possible, but the recovery to a highly functional state occurs over a period of months, not days. Capuzzo et al[12] reported survival of ICU patients at 1 year and found that survival and quality of life were based on the severity of the admitting illness and the presence of neoplastic disease; otherwise, they found that outcome paralleled life-table analysis.

Ridley et al[18–20] similarly reported that survival after ICU therapy is related to the severity of illness and to age; however, they found that the outcome of patients older than 65 years was poor. They suggested using a formula predicting survival by a simplified risk score of (age) + (APACHE II score × 3).[18] Although certainly age is factored into the APACHE II score and severity of illness is associated with survival, we cannot confirm that this multiplication factor adds substantially to survival prediction, and it certainly does not predict the functional outcome of patients who did survive.

The SIP score is a generic quality of life assessment that incorporates both physical and psychological assessment of the patient's functional status. The tool has been validated in critically ill patients and has a high degree of test–retest reliability ($r = .92$) and internal consistency ($r = .94$).[3,4] Its external validity and clinical applicability have been demonstrated in multiple studies.[12,21,22] We chose to use the SIP because of its general and broad applicability. In a large study of Dutch ICU patients, 6 months after discharge the physical dimension rather than the psychosocial dimension accounted for the greatest variance in SIP score, except in patients 30 to 50 years of age. In our study, the psychosocial dimension was important in the variance of scores from 6 months and longer, irrespective of age. SIP scores have been reported to range from 4.9 to 16.1 for ICU patients, based on the APACHE II score.[15] This compares with a SIP score of 3 for the general healthy population, 6.8 for patients after a traumatic injury, and 24 for patients with chronic obstructive pulmonary disease.[14,15,17,23]

Our study has several limitations. We did not retest the reliability or internal consistency of the SIP in our patient population. However, given that the survey has been used in this patient population previously, we believe this is a minimal limitation. Our interviewers were trained on models and test–retest reliability was performed in training sessions before patient interviews. Interviews with patients were performed by the same interviewer throughout the serial questionnaires. In some cases the patient's family helped complete the SIP forms. Although the overall reliability of the score is diminished under these circumstances, the physical score has been shown to be correlated with the actual patient answers.[24] Thus, the small number of families who answered the SIP score, especially the psychological part of the SIP score, may have altered the overall score. This most likely would bias the study toward a poorer outcome, because many families overestimate the psychological distress of patients.

The finding of a reasonable SIP score at 1 year after a prolonged SICU stay in the cohort of patients who survive to that point is encouraging. However, the cost of this 1-year survivor is substantial and the time of disability prolonged (up to 6 months). Nonetheless, continued improvement between 6 and 9 months, even in these critically ill SICU patients with diverse diagnoses and illness, offers a reasonable long-term survival and good functional recovery. Health care delivery systems must recognize that recovery of patients with prolonged surgical critical illness is possible at a large cost with good functional outcome, but that this is an extended process that requires continued medical, social, and psychological support.

References

1. Patrick DL, Starks HE, Cain KC, et al. Measuring preferences for health status worse than death. Med Decis Making 1994; 14:9–18.
2. Bergner M, Bobbitt RA, Kressel S, et al. 1981 The sickness impact profile: development and final revision of a health status measure. Med Care 1981; 19:789–785.
3. Ridley S, Jackson R, Findlay J, Wallace P. Long-term survival after intensive care. BMJ 1990; 301:1127–1130.
4. Bergner M, Bobbitt RA, Kressel S, et al. The sickness impact profile: conceptual formulation and methodology for the development of a health status measure. Int J Health Serv 1976; 6:393–415.
5. Jacobs P, Noseworthy TW. National estimates of the intensive care utilization and costs: Canada and United States. Crit Care Med 1990; 18:1282–1286.
6. Turnbull AD, Carlon G, Baron R, et al. The inverse relationship between cost and survival in the critically ill cancer patient. Crit Care Med 1979; 7:20–23.
7. Atkinson S, Bihari D, Smithies M, et al. Identification of futility in intensive care. Lancet 1994; 344:1203–1206.
8. Esserman L, Belkora J, Lenert L. Potentially ineffective care. A new outcome to assess the limits of critical care. JAMA 1995; 274:1544–1551.
9. Suter P, Acma-Ganidis A, Baaufils F, et al. Predicting outcome in ICU patients. Intens Care Med 1994; 20:390–397.
10. SUPPORT Principal Investigators. A controlled trial to improve care for seriously ill hospitalized patients. The study to understand prognoses and preferences for outcomes and risks of treatments (SUPPORT). JAMA 1995; 274:1591–1598.
11. Fakhry SM, Kercher KW, Rutledge R. Survival, quality of life, and charges in critically ill surgical patients requiring prolonged ICU stays. J Trauma 1996; 41:999–1007.
12. Capuzzo M, Bianconi M, Contu P, et al. Survival and quality of life after intensive care. Intens Care Med 1996; 22:947–953.
13. Hulsebos RG, Beltman FW, dos Reis Miranda D, Spangenberg JF. Measuring quality of life with the sickness impact profile: a pilot study. Intens Care Med 1991; 17:285–288.
14. Tian ZM, Miranda DR. Quality of life after intensive care with the sickness impact profile. Intens Care Med 1995; 21:422–428.
15. Becker GJ, Strauch GO, Saranchak HJ. Outcome and cost of prolonged stay in the surgical intensive care unit. Arch Surg 1984; 119:1338–1342.
16. Cullen DJ, Ferrara LC, Briggs B, et al. Survival, hospitalization charges and follow-up results in critically ill patients. N Engl J Med 1976; 294:982.
17. Sage W, Rosenthal M, Silverman J. Is intensive care worth it? An assessment of input and outcome for the critically ill. Crit Care Med 1986; 14:777–782.
18. Ridley S, Jackson R, Findlay J, Wallace P. Long-term survival after intensive care. Br Med J 1990; 301:1127–1130.
19. Ridley S, Plenderleith L. Survival after intensive care. Comparison with a matched normal population as an indicator of effectiveness. Anaesthesia 1994; 49:933–935.
20. Ridley SA, Wallace PGM. Quality of life after intensive care. Anaesthesia 1990; 45:808–813.
21. Heyland DK, Guyatt G, Cook DJ, et al. Frequency and methodologic rigor of quality-of-life assessments in the critical care literature. Crit Care Med 1998; 26:591–598.
22. Fernandez RR, Sanchez Cruz JJ, Vazquez Mata G. Validation of a quality of life questionnaire for critically ill patients. Intens Care Med 1996; 22:1034–1042.
23. Jurkovich G, Mock C, MacKenzie E, et al. The sickness impact profile as a tool to evaluate functional outcome in trauma patients. J Trauma 1995; 39:625–631.
24. Rogers J, Ridley S, Chrispin P, Scotton H, et al. Reliability of the next of kins' estimates of critically ill patients' quality of life. Anaesthesia 1997; 52:1137–1143. Release 7.5; SPSS Inc., Chicago, IL